PATENT SPECIFICATION

453,067

Application Date: April 15, 1935. No. 11656/35.

Complete Specification Left: April 15, 1936.

Complete Specification Accepted: Sept. 4, 1936.

PROVISIONAL SPECIFICATION

Improvements in or relating to Commutators for Dynamo Electric Machines

I, ANDREW ALLISON, of British Nationality, of 25, Putney Road, Handsworth, Birmingham, do hereby declare the nature of this invention to be as follows:—

This invention relates to commutators for dynamo electric machines and has for an object to provide an improved cooling system for such commutators. More particularly the invention relates to improvements connected with commutator bars such as are used on low voltage generators of the type used in connection with the electrodeposition of metals where it is necessary to dissipate the large amount of heat generated while keeping the brush friction losses as low as possible by keeping the diameter of the commutator small.

Broadly stated the invention consists in disposing ventilating grooves or passages through the copper bars of the commutator, the grooves being so disposed and shaped that they do not interfere with the strength of the commutator structure and that under centrifugal action the initial or pilot induced draught through the grooves or passages is assisted as soon as the commutator reaches an appreciable temperature under running load conditions.

While there are many ways of constructing a commutator making use of the above ventilating grooves, one essential feature is that air shall be admitted to the underside of the commutator bars at one end of the commutator and similarly it must be possible to withdraw air from the underside of the commutator bars at the other end. In one construction the commutator may be built on the arch bound principle, the bars being held together by means of vee rings which fit into the vee slots of the commutator bar and thus nip the copper vees, the whole being mounted on a multi-armed spider or on a grooved shaft which allows air to pass under the end ring at the one end of the commutator and up to the underside of the commutator bar. Also, the structure allows air to pass under the vee ring at the other end and away from the commutator.

In one arrangement according to the invention the commutator is built on a hollow steel shaft provided with holes which allow filtered air taken in at the end of the shaft to pass outwards from the shaft to the underside of the commutator bars, the initial pilot draught being produced by projections and ducts revolving at the peripheral speed of the armature surface or by the armature end windings. To give a numerical example in simple form, there may be twenty-two active bars in the commutator, each bar being made in halves. Each of these half bars is grooved so that when two half bars are placed together the grooves of both half bars form a ventilating passage through the bar which may be considered as a single bar. The grooves start at a point on the underside of the bar just behind or nearer to the centre of the commutator than the line at which the bar would fracture if the copper vee were torn off downwards towards the centre of the shaft and away from the working face of the commutator. They pass outwards and along the shaft in a circular path till at the point midway between the outer end of the commutator and the armature end they are just below the safe wearing circumference of the commutator. They then extend along the shaft again curving inward towards the centre of the shaft and reach the underside of the commutator bars at a point just in front of the fracture line of the back copper vee.

It will be seen that the strength of the copper vee is not impaired since the front vee would tear off in front of the groove. It will also be seen that the copper removed half way along the commutator is taken from approximately midway of the depth of the copper bar, thus the strength of this part is practically unaltered. The weight of copper removed, however, reduces appreciably the stress caused by centrifugal force at a section half way along the commutator.

In the example considered there are forty-four half bars placed in pairs so that the groove in one bar faces that in another thus forming twenty-two ventilating passages. There are only twenty-two insu-

[Price 1/-]

lating mica segments, therefore, the commutator may be said to have only twenty-two effective segments.

In another construction, twenty-two effective bars may be used. The grooves may then be deeper since the bars are thicker. When the bars are placed together they form eleven passages or grooves each divided by mica insulation. The grooves or passages may be formed on each side of the bars. The grooves may be formed by machining in the case of drawn bar sections.

All the grooves are in planes which contain the axial centre line of the shaft and form arched tubes. When the commutator is hot the weight of air and the consequent centrifugal pressure of air contained in the cold or entry arm of the arch exceeds that of the similar column of air in the hot or exit arm of the arch near the armature; thus a resultant pressure acts along these grooves in the same direction as the initial or pilot flow of air.

The design of the commutator may be modified to increase this effect or the air may be made to pass the opposite way through the commutator by a fan on the commutator end of the shaft.

The hot air may be drawn away under the back vee ring either by holes in the vee ring or grooves in a shaft or by exit holes in a hollow shaft provided the path along the underside of the bars, or along the grooved shaft, or along such a hollow shaft is so blocked that there is no appreciable air connection between entry and exit holes except through the commutator bars.

Dated this 15th day of April, 1935.
CRUIKSHANK & FAIRWEATHER,
65—66, Chancery Lane, London, W.C.2,
and
86, St. Vincent Street, Glasgow,
Agents for the Applicant.

COMPLETE SPECIFICATION

Improvements in or relating to Commutators for Dynamo Electric Machines

I, ANDREW ALLISON, of British Nationality, of 25, Putney Road, Handsworth, Birmingham, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to commutators for dynamo electric machines and has for an object to provide an improved cooling system for such commutators. More particularly the invention relates to improvements connected with commutator bars such as are used on low voltage generators of the type used in connection with the electro-deposition of metals where it is necessary to dissipate the large amount of heat generated while keeping the brush friction losses as low as possible by keeping the diameter of the commutator small.

Broadly stated the invention consists in disposing ventilating grooves or passages through the copper bars of the commutator, the grooves being so disposed and shaped that they do not interfere with the strength of the commutator structure and that under centrifugal action the initial pilot induced draught through the grooves or passages is assisted as soon as the commutator reaches an appreciable temperature under running load conditions.

While there are many ways of constructing a commutator making use of the above ventilating grooves, one essential feature is that air shall be admitted to the underside of the commutator bars at one end of the commutator and similarly it must be possible to withdraw air from the underside of the commutator bars at the other end.

In the accompanying drawings Fig. 1 represents somewhat diagrammatically a part longitudinal cross section through a commutator built on the arch bound principle and constructed in accordance with the present invention, while Figs. 2, 3 and 4 are respectively cross-sections the two latter showing modifications.

Referring to Fig. 1 of the drawings commutator bars 1 are held together by means of vee rings 2 which fit into corresponding vee slots of the commutator bars 1 and thus nip the copper vees.

The commutator bars are built on a hollowed steel shaft 3 provided with holes 4 which allow filtered air taken in at one end of the shaft 3 to pass outwards from the shaft to the underside of the commutator bars 1. Each bar is provided with a groove 5 starting at a point on the underside of the bar just behind or nearer to the centre of the commutator than the line 8 at which the bar would fracture if the copper vee were torn off downwards towards the centre of the shaft and away from the working face of the commutator. Each groove passes outwards lengthwise of the shaft in an arcuate path till at the point midway between the outer end of the

commutator and the armature end it is just below the safe wearing circumference of the commutator. The groove then extends lengthwise of the shaft again curving inward towards the centre of the shaft 3 and reaches the underside of the commutator bars 1 at a point just in front of the fracture line 8 of the back copper vee.

The initial pilot draught is produced by projections and ducts revolving at the peripheral speed of the armature surface or by the armature end windings, the flow of air being indicated by the direction of the arrows, the air being drawn away through holes 7 provided in the back V-ring 2.

To give a numerical example in simple form, there may be twenty-two active bars in the commutator, each bar being made in halves 1*a*, 1*b*, as shown in Fig. 2. Each of these half bars 1*a* and 1*b* is grooved at 5*a* so that when two half bars are placed together the grooves of both half bars form a ventilating passage through the bar which may be considered as a single bar.

In the example considered there are forty-four half bars 1*a*, 1*b* placed in pairs so that the groove 5*a* in one bar faces that in another thus forming twenty-two ventilating passages. There are only twenty-two insulating mica segments 6. Therefore, the commutator may be said to have only twenty-two effective segments.

In the construction illustrated in Fig. 3 twenty-two bars may be used. The grooves or passages 5*a* are formed on each side of the bars. When the bars are placed together they form twenty-two passages or grooves each divided by mica insulation 6. The grooves may be formed by machining in the case of drawn bar sections.

In the construction illustrated in Fig. 4 there may be twenty-two commutator bars 1, each bar being provided with a groove 5 which is divided from the adjacent commutator bar 1 by mica insulation 6, thus providing twenty-two grooves or passages. The grooves may then be deeper since the bars are thicker.

It will be seen that the strength of the copper vee is not impaired since the front vee would tear off in front of the groove. It will also be seen that the copper removed half-way along the commutator is taken from approximately midway of the depth of the copper bar, thus the strength of this part is practically unaltered. The weight of copper removed, however, reduces appreciably the stress caused by centrifugal force at a section half-way along the commutator.

All the grooves are in planes which contain the axial centre line of the shaft and form arched tubes. When the commutator is hot the weight of air and the consequent centrifugal pressure of air contained in the cold or entry arm of the arch exceeds that of the similar column of air in the hot or exit arm of the arch near the armature; thus a resultant pressure acts along these grooves in the same direction as the initial or pilot flow of air.

The design of the commutator may be modified to increase this effect or the air may be made to pass the opposite way through the commutator by a fan on the commutator end of the shaft.

The hot air may be drawn away under the back vee ring by grooves in a shaft or by exit holes in a hollow shaft provided the path along the underside of the bars, or along the grooved or hollow shaft, is so blocked that there is no appreciable air connection between entry and exit holes except through the commutator bars.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A commutator for dynamo electric machines built on the arch bound principle and the bars of which are formed with ventilating passages or grooves on the side remote from the working face of the commutator such grooves starting from behind the slot in the bar engaged by its support at one end and terminating short of the slot in the bar engaged by its support at the other end.

2. A commutator for dynamo electric machines as claimed in claim 1 in which the commutator bars are formed of mating halves each half being provided with an arcuate groove adapted to co-operate with the arcuate groove of the adjacent half to form a ventilating passage.

3. A commutator as claimed in claim 1 in which the commutator bars are formed on each side face with arcuate grooves constituting in conjunction with mica or like insulation the ventilating passages.

4. A commutator as claimed in claim 1 in which each bar is formed on one face thereof with an arcuate groove or channel adapted to form a ventilating passage in conjunction with the adjacent bar and insulation.

5. A commutator for a dynamo electric machine the bars of which are constructed and arranged substantially as described and as illustrated in Figs. 1 and 2 of the accompanying drawings.

6. A commutator for dynamo electric machines the bars of which are con-

structed and arranged substantially as described and as illustrated in Figs. 3 or 4 of the accompanying drawings.

Dated this 15th day of April, 1936.

CRUIKSHANK & FAIRWEATHER,
65—66, Chancery Lane, London, W.C.2,
and
86, St. Vincent Street, Glasgow,
Agents for the Applicant.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1936.

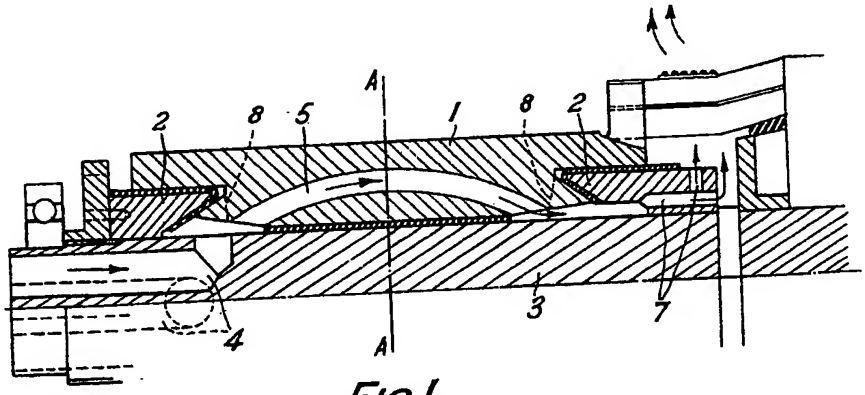

FIG.1.

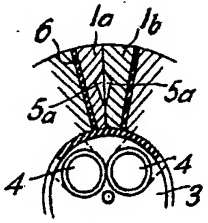

FIG.2.

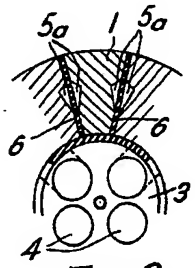

FIG.3.

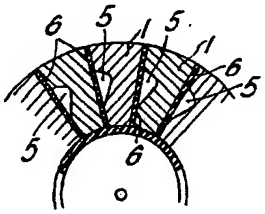

FIG.4.

Malby & Sons, Photo-Lith

AUSGEGEBEN
AM 9. JULI 1919

— № 313299 —

KLASSE 21d GRUPPE 20

ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT IN BERLIN.

Stromwendersteg für elektrische Maschinen.